REMARKS

The rejection of Claims 1-3, 5, 6, 10, 12, 14, and 15-19 under 35 U.S.C. § 103(a) as unpatentable over U.S. 5,197,242 (Baughman et al) in view of U.S. 6,113,811 (Kausch et al), is respectfully traversed.

The present invention relates to a method of making a polyvinyl alcohol film having uniform optical characteristics over a relatively large area, and having a relatively large width, the polyvinyl alcohol film being suitable for use as a polarization film in a liquid crystal display (LCD) having a large screen.

As described in the specification under "Description of the Prior Art" beginning at page 1, second paragraph, polyvinyl alcohol-based polymers (PVA) films have been used in making polarizers for LCDs. Prior art methods of forming such films have included casting on a belt or drum in which a film material in the form of a solution or melted substance is fed onto a heated belt or drum, and dried to form a film. However, it has been difficult to obtain a film having a uniform thickness, and thickness irregularities have been of two types, one is a (1) large waviness containing unevenness in thickness over an area of length within several cm to some 10 cm along the TD direction, and (2) local streaks caused by thickness irregularities occurring on a film over an area of a length within 1 mm.

The present invention is concerned with type (2) irregularities, i.e., wherein linear streaks (unevenness) may occur continuously along the MD direction (longitudinal direction) from a discharging portion or lip of a die with the lapse of time in discharging a film material from the die. Although this streak was not conventionally recognized as a problem, this problem has been discovered with the recent increase in screen size and increase in screen luminance of LCDs, when a PVA film has streaks, a polarization film produced from this film shows color irregularity, leading to an optical defect. No successful technology directed to solving this local streak defect has been known to date. Also, with the recent increase in

screen size of LCDs, optical films having a width of at least 2 m are required. However, it is necessary to connect belts along the MD direction when using the method of casting on a belt to produce films having such minimum width. As a consequence, when a PVA film material is discharged onto a belt and dried, the product cannot be used as an optical film in some cases, due to various optical insufficiencies caused by local streaks on the connecting portion of the belts.

The present invention is directed to solving the above problems. As recited in new Claim 20, the invention is a method of making a polyvinyl alcohol film, which comprises the steps of: preparing a film material containing polyvinyl alcohol, 0.01 to 1 part by weight of a nonionic surfactant relative to 100 parts by weight of the polyvinyl alcohol, and water, said film material having a volatile component in a quantity within the range of 50 to 90% by weight; and discharging the film material from a die of a flexible lip system onto a surface of a drum to form a polyvinyl alcohol film on said drum surface; wherein said polyvinyl alcohol film has a thickness within the range of 20 to 150 μm and also has a width of at least 2 m, a variance of said film thickness along the transverse direction being 0.5 μm/mm or less.

The specification contains comparative data showing the importance of various, not previously known, result-effective variables on the qualities of the polyvinyl alcohol film. Examples 1-4 are according to the present invention. Comparative Examples 1-4 are for purposes of comparison. The films produced were measured for variance in thickness per unit mm along the TD direction, as described in the specification at page 13, lines 3-8. The data is shown in Table 1 at page 19 of the specification, a copy of which is attached herewith. Comparative Example 1 used a cationic surfactant instead of a non-ionic surfactant. Comparative Example 2 employed a film having a different volatile component factor and a different die method. Comparative Example 3 employed a belt rather than a drum.

Comparative Example 4 employed a different stretching ratio. Table 1 shows that all of these changes were result-effective, not appreciated by the applied prior art.

In the Final Office Action at page 3, lines 12-14, the Examiner states: "With regards to the limitation that the film has a thickness [sic, width] of 2m or more, the Examiner takes the position that for a 2m or larger window the polarizer must inherently be 2m or larger." However, a film 2m or larger in width is not the same as one with that width having a uniform thickness. This is proved by the fact that there was no film with a width of 2m or larger in the prior art. The reason for non-existence of such a wide film is that no productive method existed prior to the present invention. As described in the subject specification at page 2, lines 6-20, and as described above, there are two methods of producing a PVA film. One involves casting on a belt; the other involves casting on a drum.

In the first method, since no belt with a width of 2m or larger is industrially available, two or more belt pieces would be connected in parallel, as described in the specification at page 3, lines 10-17, and as a consequence, the PVA film produced bears streaks at a portion corresponding to connecting portions of the belt pieces. On the other hand, in the second method, when a film material is discharged from a die onto the drum, local streaks (unevenness) occur continuously along the MD direction with the lapse of time due to successive dry-out of the material on the drum. Such streaks cause color irregularities of the film.

As discussed above, according to the prior art methods no PVA film with a width of 2m or larger and with sufficiently uniform thickness was produced to meet the demand for increase in screen size of LCD.

Now it is clear that the present invention finds its technological significance in providing a PVA film with uniform optical characteristic over a large area or large width, which film is suitable for use of a polarization film in a large LCD.

According to the present invention, addition of the nonionic surfactant in a quantity ranging from 0.01 to 1 part by weight relative to 100 parts by weight of PVA, as described in the specification at page 8, lines 10-14, and discharge of the film material from the die of the flexible lip system onto the drum surface, as described in the specification at page 9, lines 14-18) are particularly important in making the PVA film free from the problem associated with the local streaks.

The specific quantity (i.e., within the range of 50 to 90% by weight) of the volatile component in the film material is particularly important where the PVA film is desired to be manufactured having a uniform thickness in the TD direction of the film. See, for example, the specification at page 8, last paragraph.

Baughman et al disclose a dual pane thermal window with liquid crystal shade having polarizer sheets therein. It appears that the Examiner is simply relying on Baughman et al for a disclosure that polarizer sheets are known. Applicants do not dispute this fact.

Kausch et al disclose a dichroic polarizing film made by combining polyvinyl alcohol and a second polymer. The presence of the second polymer is intended to be an improvement over polyvinyl alcohol films without such a second polymer, which tend to crack under stretching conditions (column 3, line 49 ff). Kausch et al disclose further that the films of their invention may be made in a variety of ways, such as by applying a dispersion/solution of the two polymers to the surface of a substrate by shoe coating, extrusion coating, roll coating, curtain coating, or any other coating method capable of providing a uniform coating, and that typically, the thickness of the coating is 25 to 500 μm when wet (column 4, lines 21-38).

The Examiner presumes that the polyvinyl alcohol - second polymer film of Kausch et al meets the terms of the present claims because the term "uniform coating" is used therein. In reply, Kausch et al disclose no standards by which the term "uniform coating" would be

understood and it is clear in this art that films having a surface with **no** variation in thickness, especially over the relatively large widths herein, are essentially non-existent. That Kausch et al do not distinguish among the various known methods of forming such films suggest that Kausch et al was not even aware of the above-discussed local streak-type irregularity. Nor does Kausch et al disclose or suggest anything with regard to the thickness uniformity of PVA films not containing the second polymer therein. Finally, Kausch et al clearly do not recognize the importance of the various result-effective variables discussed above with regard to the presently-claimed invention. Thus, even if one skilled in the art replaced the polarizer disclosed by Baughman et al with the polarizing film disclosed by Kausch et al, the result would still not be the presently-claimed invention.

In the Final Office Action, the Examiner continues to find that Kausch et al disclose a "uniform coating." In reply, Applicants note the discussion above with regard to the two types of thickness irregularities. It is submitted that the "uniform thickness" disclosed by Kausch et al is with reference to the thickness irregularities that are **not** related to the present invention, i.e., a large waviness containing unevenness in thickness over an area of length within several cm to some 10 cm along the TD direction. This is a valid assumption, since the PVA film disclosed by Kausch et al does not appear to have been manufactured with a goal of film width of the order of magnitude of the presently-recited width, at which width the thickness irregularities with which the present invention is concerned manifest themselves. Note that Kausch et al disclose nothing with regard to the presence of the above-discussed "local streaks."

For all the above reasons, it is respectfully requested that the rejection over Baughman et al in view of Kausch et al be withdrawn.

The rejection of Claims 7, 8, 9, 11, and 13 under 35 U.S.C. § 103(a) as unpatentable over Baughman et al in view of Kausch et al, and U.S. 3,607,812 (Takigawa et al) is

respectfully traversed. The disclosures and deficiencies of Baughman et al and Kausch et al have been discussed above. Takigawa et al does not remedy these deficiencies.

The Examiner relies on Takigawa et al for its disclosure of particular PVA films. In reply, Takigawa et al is, in essence, irrelevant to the presently-claimed invention. Takigawa et al is concerned with PVA films which are insoluble in cold water at temperatures below 40°C, but readily soluble in warmer water, which makes such films useful as a hospital bag or a packing material for products such as detergents and agricultural chemicals (column 1, lines 4-14). Without the present disclosure as a guide, one skilled in the art would not look to PVA films for the uses contemplated by Takigawa et al to solve any problem with regard to the dichroic polarizing film of Kausch et al, let alone for use as a polarization film in an LCD having a large screen. Moreover, Takigawa et al disclose extruding PVA in an anhydrous state, which is markedly different from the method recited in new Claim 20. Nor is the Examiner correct that sodium acetate is an anionic surfactant. Indeed, sodium acetate is an impurity in Takigawa et al that is produced in the course of manufacture of the PVA resin and much be removed from the resultant PVA film. In sum, Takigawa et al has nothing to do with Baughman et al, Kausch et al or the presently-claimed invention.

For all the above reasons, it is respectfully requested that the rejection over Baughman et al in view of Kausch et al and Takigawa et al be withdrawn.

All of the presently pending claims in this application are now believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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